If we put n and t each $=50$, we find $p=\frac{1}{25}$, and $S=45.38431$. Hence the No. of white marbles in B's bag at the end of the 50th transfers will be at least 4. If we make $S=25$, we shall find $25p-1 = (1-p)^t$, which gives $0=(1-p)^t$, and $0=(\frac{24}{25})^t$; but this can only happen when t is infinite. Hence, after an inf. No. of trans. B will find half of A's marbles in his bag.

PROBLEMS.

423. *By E. Millwee, Add-Ran College, Granbury, Texas.*—Given the hypothenuse of a right-angled triangle and the difference of the two lines drawn from the acute ang's to the centre of the ins'd circle, to find the triang.

424 *By Prof. De Volson Wood.*—Required the equation to the locus which is at a constant, internal, normal dist. from the four cusp epicycloid.

425. *Id.*—A cylinder rolls down the upper plane of a wedge, the wedge being upon a perfectly smooth horizontal plane; required the velocity of the cylinder when it shall have rolled a distance l on the plane.

426. *By William Hoover, A. M.*—Eliminate θ from the equations

$$(a+b)\tan(\theta-\varphi)=(a-b)\tan(\theta+\varphi), \tag{1}$$

$$a\cos 2\varphi+b\cos 2\theta=c. \tag{2}$$

427. *By Prof. J. W. Nicholson.*—C and D are two fixed points (1 dist. apart) on the line AB; show that the locus of a point P, moving in such a manner that $\angle PDB=n\angle PCB$, the origin being at C, is

$$\frac{y\sqrt{-1}}{x-1}=\frac{(x+y\sqrt{-1})^n-(x-y\sqrt{-1})^n}{(x+y\sqrt{-1})^n+(x-y\sqrt{-1})^n}.$$

PUBLICATIONS RECEIVED.

Signal Service Tables of Rainfall and Temperature Compared with Crop Produc'n [Professional Paper No. X.]. 4to. Washington. 1882.

Parallax of a Lyræ and 61 Signi. By ASAPH HALL, Professor of Mathematics, U. S. Navy. 4to. 64 pp. Washington. 1882.

The Theory of the Gas Engine. By DUGALD CLARK. 16mo. 164 pp. New York: D Van Nostrand, Publisher. 1882. Price 50 cts.

The American Engineer, 182–184 Dearborn Street, Chicago, Ill. An illustrated Journal, Scientific and Practical, *Published Weekly*. Sub. Price for U. S. and Canada, $4 per year.

On the Spherical Triangle Proof of the Addition Equation in Elliptic Functions. By Professor WILLIAM WOOLSEY JOHNSON. [Ext. from Q. Jour. of Pure and Ap'd Math., No. 72.]

Systems of Formulæ for the sn, cn, and dn of $u+v+w$. By Prof. W. W. JOHNSON. [Extracted from the Proceedings of the London Math. Soc. Vol. XIII, No. 186.]

On the Composition of Errors from Single Causes of Error. By CHAS. H. KUMMELL, of U. S. Coast and Geodetic Surv., Wash. D. C. [Rep. from *Astronomische Nach., No.* 2460-61.

The Intersection of Circles and the Intersection of Spheres. 24 pp. By BENJAMIN ALVORD, Brig. Gen. U. S. A. [Reprinted from *Amer. Jour. of Mathematics,* Vol. V, No. 1.]

In this Memoir Gen. Alvord solves geometrically all the questions in Intersections, by the same principle, in effect, as was used by him in the memoir on "The Tangencies," publish'd in the Smithsonian Contribution, Vol. 8, 1855.—The question in Intersections is reduced to one in tangencies and orthogonals. There is an evolution throughout the whole investigation from the principle of the radical center, that is; the radical axes of three given circles intersect each other in a point, called the radical center, which is also the center of the circle orthogonal to said circles. The radical center of four spheres is found in like manner.—All questions in Spheres are reduced to those in Circles.

Naming the General question (without considering the various cases), the following are the problems solved, and the number of solutions to each.

1. To draw a circle to cut each of three given circles at the same given ang., 8 solutions.
2. To draw a sphere to cut each of five given spheres at a given angle, 16 "
3. To draw a circle to cut each of five given circles at the same angle (angle being unknown), 96 "
4. To draw a sphere to cut each of five given spheres at the same angle (angle being unknown), 640 "

It is believed that the last two questions have never been solved geometrically heretofore; nor was it known that there were so many solutions. Some of them are imaginary. Thus in circles the required circle may often not intersect either of the given circles, but will be situated in a similar manner toward each.

Prof. Arthur Cayley, F. R. S., who happen'd to be in Baltimore when the paper was offered, appends a valuable note at page 10.

Mr. Marcus Baker in the ANALYST for July, 1877, page 128, proposed the last question for solution. R. J. Adcock, in the ANALYST for September, 1877, page 158, gave the equations for solution of that question, and Thomas Craig, in ANALYST for Jan. 1880, p. 13, gave an analytical solution by the method of determinants.

If Steiner, who proposed the last two questions in the 1st Vol. of Crelle, 1826, ever solved them, or if he published such solution, such fact is unknown to the best accessible authorities.

ERRATA.

On page 176, Vol. IV, *dele* $\sqrt{2}$ in last term of the value of I_5.
" " 164, line 8, of Vol. IX, for "persons" read insured persons.
" " 178 of Vol. IX, lines 5 and 8 from bottom, insert sign of integration after $\times$ at the beginning of each line.
" " 3 of Vol. X, line 4 from bottom, for lower limit of int. read ax.
" " 10 line 7, for $6a$ read $6a^2$.
" " 12 " 4, for $\sin x$ under the sign of integration read $\sec x$.
" " 13 " 16, insert minus sign after the sign of equality.
" " 13 " 17, for "This", read These.
" " 14 " 5, for the exponent "$n+2$", read $n-2$.

In Table " " 120 of Vol. IX, in $\sqrt{2}$, after the 124th dec., read 360558507372126441 and in $\sqrt[3]{2}$ omit the last 13 decimals; in $\sqrt{8}$, the 23rd decimal is 7; in $\sqrt{10}$, the 102nd dec. is 5, and in $\sqrt{15}$, the 24th decimal is 5.